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ADAPTIVE SCAN DRIVER AND SCAN PERIPHERAL

FIELD OF THE INVENTION

The field of the invention is scan peripherals. The invention is directed toward a driver for controlling scan jobs directed to a scan peripheral. A driver of the invention may be embodied in a dedicated peripheral server.

BACKGROUND OF THE INVENTION

A scan peripheral is a scanner or multi-function device including a scanning function. Scan peripherals may be accessed through a server so that multiple users may use the same scan peripheral over a network, for example. A single machine may also directly access or share access to a scan peripheral or multiple peripherals through a server. A single machine might also contain a driver to interface to a scan peripheral directly.

A scan peripheral server is typically realized in software that is installed in some type of general purpose computer system. Hardware might also be used, but would be more difficult to realize. Server software may be run in the general purpose computer of a specialized physical device, such as a Hewlett-Packard JetDirect® external or internal server. JetDirect® devices can control multiple scan peripherals, including scanners and multi-function peripherals. Each scan peripheral requires a driver, which functions to control a scan job from a particular peripheral according to the capabilities and protocol for the particular

1 peripheral. A JetDirect® server or other server that interfaces to multiple scan
2 peripherals typically includes multiple drivers to facilitate control of scan jobs
3 from different scan peripherals.

4 A problem arises when a scan peripheral server having a set of
5 drivers or a stand-alone driver encounters a scan peripheral unaccounted for by the
6 existing driver(s). This may happen, for example, when scan peripherals are
7 replaced with new scan peripherals or new scan peripherals are added. In such a
8 case, a new scan peripheral will not work with the old server/driver and a user
9 must take additional inconvenient steps to make the new scan peripheral work.
10 Expense and frustration often result.

11 Thus, there is a need for an improved scan peripheral driver. It is an
12 object of the invention to provide such a driver. A further object of the invention
13 is to provide an improved scan peripheral server and improved scan peripheral.

14 SUMMARY OF THE INVENTION

15 A driver of the invention meets such a need by adapting to scan
16 peripherals using information in a capability descriptor provided by a scan
17 peripheral or a capability descriptor associated with a scan peripheral based on the
18 model of the scan peripheral. A driver of the invention automatically determines a
19 scan peripheral's capabilities using information from the capability descriptor, and
20 uses the information to configure itself from a set of driver modules. A user
21 interface and scan job are then run through options enabled by the appropriate set
22 of driver modules as determined by the capability descriptor.

23 A preferred embodiment server of the invention embodies such an
24 adaptive driver that queries a scan peripheral when it is first connected to the
25 server. If an appropriate capability descriptor is obtained in response to the query,
26 the capability descriptor is stored for use during a scan job. When a scan job using
27 that peripheral is requested, user interface code extracts information from the
28 capability descriptor to allow the user interface to dynamically change dependent

1 upon the peripheral's capabilities as indicated by the information from the
 2 capability descriptor. Capabilities indicated by a capability descriptor might
 3 include, for example, dots per inch choices, paper sizes, color/grayscale options,
 4 image formats, and whether or not a preview scan is supported. The appropriate
 5 capabilities become selectable through a user interface at a client computer. When
 6 a scan job is directed, scan driver software/firmware uses selected parameters
 7 passed by the client and the information from the stored capability descriptor to
 8 determine an appropriate command protocol and image encoding. A set of driver
 9 modules is then dynamically linked to create an appropriate driver for the scan job.

10 The invention also includes a scan peripheral or multi function
 11 peripheral capable of supplying a capability descriptor in response to a request.
 12 The preferred driver of the invention expects to receive a capability descriptor.
 13 However, in an aspect of the invention, the preferred driver or a preferred server
 14 including the driver may also address the case of scan peripherals or multi
 15 function peripherals that are not capable of providing a capability descriptor in
 16 response to a request. In this aspect of the invention, the preferred driver includes
 17 stored capability information corresponding to a set of known scan peripherals or
 18 multi function peripherals. When the driver fails to receive an appropriate
 19 capability descriptor in response to a request, the driver then selects from the
 20 stored capability information based upon the model of scan peripheral. Model
 21 information is typically provided by conventional scan peripherals on request.

22 BRIEF DESCRIPTION OF THE DRAWINGS

23 FIG. 1 is a block diagram illustrating a preferred server of the
 24 invention connected to a network and multiple peripherals;

25 FIGs. 2a and 2b are a flowchart illustrating steps performed by a
 26 preferred driver program of the invention and

27 FIG. 3 is a block diagram for a preferred driver program of the
 28 invention usable in the server of FIG 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

1 The invention, in its most preferred embodiment, includes a scan
2 peripheral, i.e., a scanner or a multi-function scan peripheral, that provides a scan
3 driver a capability descriptor that the driver can use to dynamically configure
4 itself. However, a driver of the invention may also account for the case where a
5 scan peripheral is unable to provide a capability descriptor by determining a model
6 of the scan peripheral and selecting an appropriate predetermined capability
7 description for the scan peripheral. The invention is particularly beneficial to
8 dedicated servers, such as Hewlett-Packard JetDirect® servers, that operate with
9 many different types of peripherals. Such servers operate under constraints that
10 make it harder to deploy and install new software to address a peripheral model
11 unaccounted for by the software originally resident in the server. Artisans will
12 appreciate that the adaptive driver part of the invention may also be realized
13 outside of a dedicated server as software or in any general purpose computer
14 having a peripheral interface.

15 FIG. 1 illustrates the preferred case where a preferred server 10
16 connects a peripheral 12 to a network 13 accessible by one or more client
17 computers 14. The server 10 also provides an interface to one or more additional
18 peripherals 16a, 16b. The server 10 includes a driver 18. The driver 18 might
19 alternately be resident in another device, such as a computer or server directly
20 interfaced to one or more peripherals.

21 The peripheral 12 and peripherals 16a, 16b are preferably
22 constructed in accordance with the invention to provide a capability descriptor in
23 response to a query by the driver 18. A capability descriptor provides information
24 about the scan capabilities offered by the peripheral and is preferably realized as a
25 data string. The capability descriptor may include, for example, one or more of

1 dots per inch choices, paper sizes, color/grayscale options, image formats, and
2 whether or not a preview scan is supported.

3 Referring now to FIG. 2a, the manner in which the preferred driver
4 18 of the invention conducts a scan job is shown. A scan job is initiated 20 upon a
5 request from a client computer. Memory is checked 22 to see if a capability
6 descriptor has been previously stored for the scan peripheral to which the scan job
7 is directed. If there is no previously stored capability descriptor, a query is made
8 to obtain 24 a capability descriptor from the peripheral to which the scan job is
9 directed. It is then determined 26 whether an appropriate capability descriptor has
10 been received. A received capability descriptor is stored 28 in memory for future
11 use with scan jobs associated with the peripheral from which it was received. If
12 there is no received or previously stored capability descriptor, the response to the
13 query from the scan peripheral is checked 30 for model information. This will be
14 the case where the scan peripheral has not been made to provide capability
15 descriptors. Model information is typically provided by conventional scan
16 peripherals on request. If necessary, a separate request for the model information
17 is conducted. Using the model information, memory is referenced 32 to select a
18 pre-stored capability descriptor that matches the model information.

19 Information contained in the capability descriptor provides the basis
20 for identifying the exact nature of scanning supported by a scan peripheral with
21 which the capability descriptor is associated. The preferred example in FIGs. 2a
22 and 2b provides a standard set of capability options, though others are possible.
23 The capabilities of the scan peripheral obviously affect the type of scan which can
24 be selected, so the driver operation in FIG. 2a first examines the capabilities to
25 alter a user interface provided on a client machine which initiated the request for a
26 scan job.

27 In the preferred embodiment of FIG. 2a, a capability descriptor is
28 examined for whether its associated scan peripheral supports color scanning 34,
29 for the associated scan peripheral's maximum scan size 36, for whether the

1 associated peripheral supports a flatbed scan 38, and for whether the associated
2 peripheral supports the JPEG image format 39. For purposes of illustrating the
3 invention, typical dynamic options are shown. Other choices, such as PDF and
4 TIFF formats, are assumed to be always available in the driver. The list of options
5 to be enabled may be altered as a matter of design choice, as will be recognized by
6 artisans. For each dynamic option in FIG. 2a, a positive indication results in the
7 option being enabled. Thus, in FIG. 2a, options may be enabled for a color scan
8 40, for a legal size scan 42, for a photo size scan 44, and for a JPEG format 46.

9 Each enabled option is submitted 47 to the client. This allows
10 activation of appropriate options within a scan interface in the client machine.
11 Once a user selects parameters for a scan from among the enabled options and any
12 other standard parameters, scan driver initialization commences 48 as shown in
13 FIG. 2b. Returned parameters allow the driver 18 to configure itself based upon
14 those selected parameters and the scan peripheral's capabilities. As in FIG. 2a,
15 only typical dynamic options based on the capability descriptor are illustrated, i.e.,
16 a typical set of options that might vary from one model of scan peripheral to
17 another. There are many more possible parameter choices that do not depend on
18 the descriptor, i.e., parameter choices commonly shared by most, if not all, scan
19 peripherals. The latter type of parameter choice is not illustrated in FIG. 2b in
20 order to keep the illustration simple.

21 In FIG. 2b, the driver 18 checks the control language 50 and then
22 configures itself according to the control language, for example, as a first language
23 configuration 52 or as a second language configuration 54. Scanning control
24 languages may be manufacturer specific languages or industry shared languages.
25 Support for ADF (automatic document feed) is checked 58 and a corresponding
26 ADF scan 62 configuration is made. An image format parameter is checked 64
27 and the appropriate image format is configured, for example, as a TIFF format 64,
28 a JPEG format 68 or a PDF format 70. Using the configured driver modules, the
29 scan is then executed 72.

The modules allowing the driver 18 to configure itself are separate driver modules which become linked for a scan job according to selected parameters and capabilities. Driver modules must be organized to permit such linking. A preferred organization for driver modules is shown in FIG. 3. As in FIGs. 2a and 2b, only an exemplary set of dynamic modules are accounted for in FIG. 3, while others are likely to be used in practice. Driver modules on the same row are alternates. This permits linking through only one module from each row since the modules in each row are mutually exclusive choices. The organization in FIG. 3 is logical, of course, and any suitable software/firmware architecture may be employed to realize the logical organization and linking operation of the driver modules.

Referring to FIG. 3, which is based upon the available options in FIG. 2b, first language and second language modules 74, 76 form alternate options, and the image format modules, TIFF module 80, JPEG module 82 and PDF module 84 form alternate options. Scan data is routed through the enabled modules for the duration of a scan job executed by step 72 in FIG. 2b. The next job might request a different format and might be routed to a peripheral having different capabilities, so the data will likely be routed through different modules.

A scan interface module 86 interfaces the driver 18 to the rest of the system. The definition of the remaining system will vary according to where the driver is resident. In the case of the driver being in a network connected peripheral server, such as a JetDirect[®], it includes a network code to transfer data to a destination client PC. In the case of a directly connected device, it is the interface to the software that requested the scan job. That software might display the image to the user, might insert it into a word processor document, might attach it to an e-mail message, might automatically archive it in permanent storage, etc. A device interface module 88 communicates with a scan peripheral 12. In the case where the driver is resident in a server, such as a JetDirect[®], the device interface

1 88 may interface to multiple scan peripherals, or a scan peripheral and other types
2 of peripherals, or any combination of common and different type peripherals.

3 Artisans will appreciate the flexibility provided by the invention. A
4 driver of the invention dynamically handles scan peripherals having different
5 capabilities without the need for update of the driver, a feature which is especially
6 useful in a peripheral server.

7 While various embodiments of the present invention have been
8 shown and described, it should be understood that other modifications,
9 substitutions and alternatives are apparent to one of ordinary skill in the art. Such
10 modifications, substitutions and alternatives can be made without departing from
11 the spirit and scope of the invention, which should be determined from the
12 appended claims.

13 Various features of the invention are set forth in the appended
14 claims.